Comparison White Paper
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SUSE® Linux Enterprise Server 9 and Solaris* 10 on x86

Novell®

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Executive Summary

1 *OpenSolaris is the name given to the open source version of Solaris. Its code is distributed under an open source license created specifically by Sun to prohibit the intermixing of Solaris code and Linux code.*

Sun Microsystems has positioned Solaris* 10 on x86 (written Solaris 10/x86) as an alternative to Linux*. On the surface, Sun* appears to have a reasonable story to spin around Solaris 10/x86 in comparing it to Linux. Sun hypes its allegedly lower support costs, the Solaris feature set and indemnification. However, you should consider a number of other things before believing what Sun says. For example, Solaris 10/x86 is behind Linux in performance on industry standard benchmarks, application availability, market share and hardware-platform availability.

Overview

For Solaris 10/x86 to compete with Linux, Sun must be successful in a number of areas:

- *Promoting its x86 platforms, sometimes at the expense of its SPARC platforms*
- *Gaining adoption and support of independent hardware vendors (IHVs) and independent software vendors (ISVs)*
- *Attracting an open source community around OpenSolaris*[1]
- *Halting the migration from Solaris to Linux platforms*

Competitive Summary

Area of Comparison	SUSE® Linux Enterprise Server 9	Solaris 10/x86
Performance	SUSE Linux Enterprise Server 9 is the leading Linux distribution as well as the leading operating system in several well-known industry-standard benchmarks.	Solaris 10/x86 rarely, if ever, shows up among the industry-standard benchmark leaders.
Application Availability	SUSE Linux Enterprise Server 9 has hundreds more ISV applications certified than does Solaris 10/x86.	Solaris 10/x86 has a lackluster start in attracting ISVs and will gain minimal support from IHVs like HP or IBM.
Scalability	SUSE Linux Enterprise Server 9 scales to 64-way and beyond.	Solaris 10/x86 scales to 64-way and beyond.
Stability	SUSE Linux Enterprise Server 9 is very stable.	Solaris 10/x86 is very stable.
Security	SUSE Linux Enterprise Server 9, integrated with Novell® AppArmor, powered by Immunix™, provides enterprises with a high degree of security. SUSE Linux Enterprise Server 9 has the highest security certifications of commercial operating systems—CAPP/EAL 4+.	Solaris 10/x86 has not been certified at the level of SUSE Linux Enterprise Server 9. Certifications, however, are underway. Trusted Solaris will be revised to run as a layered product on top of Solaris 10.

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Area of Comparison	SUSE Linux Enterprise Server 9	Solaris 10/x86
Maintenance and Support	SUSE Linux Enterprise Server 9 is very economical for enterprises that buy several servers and have other Linux products in use.	Solaris 10/x86 is generally less expensive than SUSE Linux Enterprise Server 9 when few servers are in use, but more expensive when 20 or more are in use.
Hardware Availability	SUSE Linux Enterprise Server 9 is available on 1A-32, Itanium* 2, AMD*, EM46T, POWER*, zSeries* and S/390*.	Solaris 10/x86 is available on 1A-32, AMD64 and EM64T. A port to PowerPC is underway.
Virtualization	The next release of SUSE Linux Enterprise Server will utilize Xen, an open source product.	Solaris 10/x86 uses Solaris Containers to provide some virtualization capabilities. Sun will make Xen available with Solaris 10 at an unspecified time.
Indemnification	Novell indemnifies its Linux customers.	Sun indemnifies its Solaris 10/x86 customers.
Licensing	SUSE Linux Enterprise Server 9 is distributed under a Novell EULA.	OpenSolaris is distributed under the Common Development and Distribution License, a Sun-defined open source license.

Table 1. *Source: Novell, Sun, January 2006*

Performance

We examined four industry-standard benchmarks—TPC-C[2], TPC-H[3], SPECweb99_SSL[4] and SPECjbb2000[5]—whose results are published on the Web. The results are used to gauge how SUSE Linux Enterprise Server 9 and Solaris 10/x86 fared from a performance point of view:

- **TPC-C by Price/Performance benchmark**—*an online transaction processing benchmark measure in price per transactions per minute (tpmC).*
- **TPC-H benchmark**—*a decision support benchmark consisting of a suite of business-oriented ad-hoc queries and concurrent data modifications. The TPC-H Price/Performance metric is expressed as $/QphH@Size (queries per hour at various database sizes—100 GB, 300 GB and so forth).*
- **SPECweb99_SSL benchmark**—*an industry-standard benchmark that measures the performance capabilities of a Web server with added SSL encryption/decryption.*
- **SPECjbb2000 benchmark**—a benchmark that measures the performance of a Java*-implemented application tier by emulating a three-tier system.

2 www.tpc.org/tpcc/default.asp
3 www.tpc.org/tpch/default.asp
4 www.spec.org/osg/web99ssl
5 www.spec.org/osg/jbb2000

The results for the four benchmarks, valid as of first quarter 2006, are presented in Table 2.

Benchmark Results

Benchmark	SUSE Linux Enterprise Server 9	Solaris 10/x86
TPC-C by Price/ Performance	SUSE Linux Enterprise Server 9, ranked fifth, is the highest-ranked Linux operating system in the top ten.	There are no Solaris 10/x86 entries in the top ten.
TPC-H	SUSE Linux Enterprise Server 8 (clustered) on an IBM e325 server is ranked second with QphH of 12,216, and SUSE Linux Enterprise Server 9 on an IBM OpenPower 720 is ranked seventh with a QphH of 6,357.	There are no Solaris 10/x86 entries in the top ten.
SPECweb99_SSL	SUSE Linux Server 9 had the top three results in 2005.	There are no Solaris 10/x86 entries in the top ten.
SPECjbb2000	SUSE Linux Enterprise Server 9 SP2 running on a two-processor Tyan Computer Corporation server (AMD Opteron* 254 processors) produced a result of 104,364 ops/second.	Solaris 10/x86 running on a two-processor Sun Fire* x4100 (AMD Opteron 254 processors) produced a result of 85,957 ops/second.

Table 2. *Source: Novell, January 2006*

Application Availability

SUSE Linux Enterprise Server 9 has more than 1,200 ISV-certified applications and hundreds of ISV partners. These include several tier-one ISVs: BEA, CA, IBM, Oracle and Veritas. Solaris 10/x86 does not have the library of applications behind it that Solaris/SPARC does, creating a momentum issue for Sun.

Sun recently said that it has over 600 applications committed to, but not yet certified on, Solaris 10/x86. Solaris 10/x86 is also far behind SUSE Linux Enterprise Server 9 in terms of packaging and supporting open source technology. SUSE Linux Enterprise Server 9 ships with 1,000 or more open source packages, while Solaris 10/x86 ships with about 60.

Solaris/SPARC and Solaris 10/x86 are not binary-compatible, and there is a risk of data incompatibility because Solaris 10/SPARC data is big endian and Solaris 10/x86 data is little endian. As a result, moving applications from Solaris 10/SPARC to Solaris 10/x86 is usually much more than a simple recompile. Another issue holding back ISV application availability on Solaris/x86 is that it has a small fraction of the server market share. In 2004, Linux/x86 was out shipping Solaris/x86 by more than 75 to 1.[6] Only about one-third of Sun's new Galaxy servers (AMD Opteron-based) ship with Solaris 10/x86. Most of them ship with Linux and Windows*.

6 *IDC Worldwide Quarterly Server Q204, August 2004.*

To take advantage of the availability of the large numbers of Linux applications available on industry-standard platforms, Sun will offer customers Solaris Containers for Linux Applications (SCLA). SCLA was formerly known as Project Janus. According to Sun, the offering is several months away from being in a Solaris10/x86 release, and a long way from being in a release on which users would run their businesses.

Users of SCLA will have to install whatever Linux distribution that they want to use and acquire Linux support from the Linux distributor or a third party. Sun is offering the capability to run RHEL and CentOS binaries. Binaries from other Linux distributions may not run out of the box in a SCLA environment. Recompilation of applications may be required. There are some types of Linux applications that will not run in a SCLA environment. For example, applications with specific Linux kernel requirements, applications that require specific Linux device drivers, etc.

SCLA is designed to support only 32-bit applications. We question the long-term importance of SCLA because applications are being moved to 64-bit architectures, and Sun is focused primarily on selling 64-bit AMD Opteron-based servers. Most Linux applications will take a five-percent performance hit.

Sun's claim that Linux applications can run in a SCLA environment is diminished by the fact that companies would generally buy two support contracts, one for Linux and one for Solaris 10/x86. And Linux system administrators will not likely want to use Solaris systems management tools to manage Linux environments in Solaris Containers. If a Linux application crashes in a SCLA environment, Solaris core files are generated to assist with debugging. In addition, why would a customer want to deal with the problems of mixing two operating system environments to run Linux applications when running them directly on Linux is simpler and provides superior performance?

Scalability

Scalability has been one of the major advantages of Solaris and other RISC/UNIX operating systems over Linux. But SUSE Linux Enterprise Server 9 scales to eight- and 16-way machines with ease and beyond 64-way. Solaris 10/x86 also scales beyond 64-way.

Stability

Both SUSE Linux Enterprise Server 9 and Solaris 10/x86 are stable operating systems with dependable release cycles and strong maintenance/support programs.

Security

IT managers are increasingly spending higher and higher percentages of their budgets on security. The costs due to inadequate security can be high—loss of business and user productivity are big contributors. Operating systems that cannot isolate security attacks and control the damage by intruders are losing favor among IT organizations. While some vendors such as Microsoft and others are content to try to "add on" features that improve security, Novell is taking a different approach—tackling the problem head-on.

In February 2005, Novell announced that SUSE Linux Enterprise Server 9 had received the CAPP/EAL (Controlled Access Protection Profile/Evaluation Assurance Level) 4+ security certification, the highest attained by commercial operating systems. Novell AppArmor, powered by Immunix[7], protects both SUSE Linux Enterprise Server 9 and applications from external and internal attacks, viruses and malicious applications. It limits the spread of virus infection by creating a "containment shell" around an application. The shell prevents a compromised application

7 *Novell acquired Immunix, a company specializing in Linux security solutions, in April 2005.*

With Novell Identity-Driven Computing solutions that protect against user misbehavior and AppArmor that protects against software misbehavior, Novell offers one of the highest, if not the highest, levels of enterprise security in the computing industry today.

from becoming a rogue process that can inflict more damage to a computer system. SUSE Linux Enterprise Server 9 also supports security-enhanced Linux (SELinux), developed by the National Security Agency to provide mandatory access control for U.S. Department of Defense agencies and departments.

With Novell Identity-Driven Computing solutions that protect against user misbehavior and AppArmor that protects against software misbehavior, Novell offers one of the highest, if not the highest, levels of enterprise security in the computing industry today. Linux security on the 2.6 kernel has also been enhanced, allowing for the partitioning of superuser privileges. This enables restriction of system administrators' access to facilities that are not required for system administration.

Solaris is also known as a secure operating system. Solaris 10 Containers provide for the isolation of separate application and user stack environments on top of a single operating system image. In addition, Solaris' process rights management capability makes it possible for system administrators to administer systems without having the full power of a superuser (root) account. An evaluation of Solaris 10/x86 security certification is underway.

Maintenance and Support

Novell and Sun have taken significantly different approaches to providing maintenance and support for their respective operating systems. Novell offers a variety of maintenance and support programs that offer enterprises more options and lower costs. Sun's approach is to provide low-cost support for individual one-, two- and four-way servers. When a few Sun servers are in use, Sun support is less expensive than Novell support. But when several servers are involved, as is the case in many enterprises, the Novell support costs are much lower than Sun's. The characteristics of the programs are described below.

When SUSE Linux Enterprise Server 9 is purchased, the user automatically receives Upgrade Protection. Upgrade Protection provides a URL to download SUSE Linux Enterprise Server and access to a portal. The portal gives the user access to service packs, bug fixes, updates and upgrades to new releases. Upgrade Protection can be purchased for one or more years. Customers can also purchase maintenance, which is Upgrade Protection plus technical support.

The Novell and Sun support pricing in Table 3 and Table 4, respectively, for x86 servers is per socket.[8] Table 3 contains pricing for bundled support and training for small and medium sized businesses. The pricing includes the SUSE Linux Fundamentals Training Kit 3036.[9] Users that need support for several SUSE Linux Enterprise Server servers and/or other Novell Linux products are encouraged to purchase Novell Linux Small Business Support.[10] Users who need support for all Novell products in one support agreement should consider Novell Premium Service.[11]

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8 *A dual-core processor is equivalent to one socket with respect to pricing. Socket and CPU are used interchangeably in this paper.*

9 *Training Kit 3036 is a hands-on self-study course that focuses on basic Linux concepts and key SUSE Linux Enterprise Server 9 administration skills, using the Linux desktop, administering Linux with the YaST utility, managing Linux directories and files, etc.*

10 www.novell.com/support/products/linuxsmallbiz

11 www.novell.com/services/premium

Novell Maintenance/Support

Type of Maintenance/Support	Cost Per Year
Basic Support	Up to two sockets—$349
Standard Support (12x5 telephone and 24x7 electronic access, four-hour response limit)	Up to two sockets—$799 Up to 16 sockets—$1,499
Priority Support (24x7 telephone access (one-hour response limit) and electronic access (four-hour response limit)	Up to two sockets—$1,499 Up to 16 sockets—$2,499

Table 3. *Source: Novell, January 2006*

Sun's Solaris Service Plans[12] provide a choice of software support (paid) levels: basic, standard and premium. Sun provides free Web-based Solaris 10 training. End users who download and register the Solaris 10 operating system have the opportunity to download future full releases of Solaris and receive automated security patches for free. Higher levels of paid support provide all patches, updates, and phone and technical support.

Sun Maintenance/Support

Type of Support	Cost Per Year
Basic Service (no Sun technical support)	One to eight sockets—$120 per socket (available only for one to eight sockets)
Standard Service (8AM–8PM via phone; four-hour response limit)	One to eight sockets—$240 per socket More than eight sockets—$480
Premium Service (24x7 phone, one-hour response limit)	One to eight sockets—$360 per socket More than eight sockets—$600 per socket

Table 4. *Source: Novell, January 2006*

Novell support pricing in Table 3 includes support for nearly the entire 1,000 or more open source packages shipped with SUSE Linux Enterprise Server 9. Exceptions include MySQL and JBoss. Sun ships and supports only about 50 to 60 open source packages with Solaris 10/x86. Sun has announced that it has open sourced its JES (Java Enterprise System) middleware. Users can download JES components for free, but they must pay for Sun-based service and support.

12 www.sun.com/service/solaris10

13 http://news.zdnet.com/2102-3513_22-6032893.html?tag=printthis

14 Evan Bauer, Linux 2.6 and Solaris 10: An Analysis of Two Strategies for Enterprise Operating Systems, Robert Frances Group (www.rfgonline.com), February 2005.

Support Pricing Comparison for Novell Priority/ Sun Premium

Number of CPUs/ Sockets Per Server	Novell: Cost Per Year	Sun: Cost Per Year
2	$1,499	$720
4	$2,499	$1,440
8	$2,499	$2,880
12	$2,499	$7,200
16	$,2499	$9,600

Table 5. *Source: Novell, January 2006*

For those customers that have several Linux servers, say 15 or 20, Novell offers a support/ maintenance plan that includes patches, upgrades and 24x7 telephone response at a cost lower than that of Sun. For example, Sun Premium support cost for 20 servers with two CPUs each would be $14,400 (20 times $720). The Novell support cost would be $10,780 (20 times $349 plus $3,800 for Novell Linux Small Business Support). It includes patches, upgrades, and 24x7 telephone response.

Hardware Availability

SUSE Linux Enterprise Server 9 runs on at least eight architectures—IA-32, Itanium 2, Intel EM64T, AMD64 Opteron, POWER32, POWER64, S390 and S390x. Solaris 10/x86 runs on the IA-32, AMD64 Opteron and Intel EM64T architectures. The majority of Sun's AMD64 server sales are deployed with Linux, not Solaris/x86.

Solaris 10/x86 will gain little support from IHVs like Dell, HP, and IBM. Dell has not committed to any support for Solaris 10/86. HP has announced support for Solaris 10/x86, but customers will have to contact Sun for operating system support. HP says that it has certified Solaris 10/x86 on some of its x86 servers only to lure Solaris x86 customers away from Sun toward HP and Linux. IBM is reluctantly supporting Solaris 10/x86 on its BladeCenter product. The company says that customers are only using Solaris x86 on IBM x86-based eServer platforms in unusual circumstances—when it is not cost-justified to migrate to Linux on x86.[13]

A Robert Frances Group (RFG)[14] survey of Solaris/SPARC users indicates that almost none of the respondents said they would acquire Solaris 10/x86 servers in 2005. RFG said that the few firms that had tested Solaris 10 on AMD64 Opteron indicated that the hardware differences (between Solaris 10/SPARC and Solaris 10/x86) are real. The same support experience should not be expected. One major financial company told RFG that there is no advantage to staying with Solaris when moving hardware architectures. The effort and cost to port to Solaris 10 on AMD64 is no less than that of porting to Linux on AMD64.

Virtualization

SUSE Linux Enterprise Server 10 will support Xen 3.x, the open source virtual machine monitor (VMM). Xen is a paravirtualization implementation, making it capable of providing better performance than full virtualization implementations such as VMware* GSX Server. Sun has said that

Solaris 10/x86 support for Xen 3.x is also forthcoming. The Solaris 10 Container virtualization technology acts as a configuration facility within the operating system. Containers provide the isolation of separate application and user stack environments on top of a single operating system image. Xen, VMware and IBM LPARs provide isolation by running separate instances of an operating system.

Indemnification

Novell offers indemnification for copyright infringement claims made by third parties against registered Novell customers. Novell indemnified Linux products include SUSE Linux Enterprise Server 8, SUSE Linux Enterprise Server 9 and Novell Linux Desktop. Specifically, the Novell Linux Indemnification Program helps minimize customer risk by protecting customers financially if a third party files a Linux infringement claim against the customer's company. In addition, Novell will pay a company's legal defense fees.

Sun claims that it will provide full indemnification for Solaris 10/x86. However, repeated requests to Sun for a formal statement of its indemnification policy for Solaris 10/x86 have not produced a statement. No document could be located on Sun's Web site that specifies the Solaris 10/x86 indemnification policy.

Licensing

SUSE Linux Enterprise Server 9 is distributed under a Novell End User License Agreement (EULA). To reduce Solaris 10 (and subsequent releases of Solaris) development costs and to stem the adoption of Linux, Sun has open sourced Solaris 10. OpenSolaris is distributed under the Sun-created open source Common Development and Distribution License (CDDL). The CDDL is based on the Mozilla Public License (MPL) with a Sun-defined set of minor changes. OpenSolaris is not equivalent to Solaris and not all of the Solaris code has been open sourced. OpenSolaris.org has been formed. It is the governing board and rendezvous point between Sun and the open source community.

When Sun open sourced OpenSolaris, it was making the statement that OpenSolaris is competing with Linux, and that it was creating its own community of Solaris developers. Sun structured its open source license, CDDL, to prevent intermingling of GPL and CDDL code. This will have a negative effect on OpenSolaris. The CDDL will likely hamper Solaris 10 hardware and driver support because drivers licensed under the GPL cannot be ported to Solaris.

Deciding Between SUSE Linux Enterprise Server 9 and Solaris 10/x86

The three key factors that differentiate SUSE Linux Enterprise Server 9 and Solaris 10/x86 are:

1. **Performance**—*SUSE Linux Enterprise Server 9 is the x86-based operating system of choice for vendors who set records running industry-standard benchmarks. SUSE Linux Enterprise Server 9 does it on server platforms from any of the leading hardware vendors: Dell, HP and IBM. This means that customers who adopt SUSE Linux Enterprise Server 9 can almost always be assured they will get top performance, regardless of their hardware platform. Solaris 10/x86 is rarely ranked among the top 10 in any industry benchmark results.*
2. **Hardware availability**—*Users who buy SUSE Linux Enterprise Server 9 can choose from among servers based on at least eight hardware architectures (IA-32, Itanium 2, AMD64, EM64T, POWER32, POWER64, S390 and S390x). This provides customers with a large choice of server platforms. To realistically gain the benefits of Solaris 10/x86, customers must buy their hardware from Sun, and they will be limited to 32-bit Intel and AMD64 servers. Solaris 10/x86 customers will effectively be locked into Sun just as they are locked in with Solaris/SPARC.*

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3. **Application availability**—*ISVs generally support their applications on an operating system platform only when the platform has sufficient market share to make it worthwhile. Today, Solaris 10/x86 has practically no market share in the x86 market, which is dominated by Linux (and Windows). Sun will have problems convincing ISVs to port their applications to Solaris 10/x86 given Sun's history of up-and-down interest in Solaris on x86 and its overwhelming support for Solaris/SPARC.*

Conclusions

Sun is banking its hopes on thwarting the adoption of Linux, rebuilding its dwindling Solaris installed base and reducing Solaris development costs on Solaris 10/x86. The rapid acceptance of Linux operating systems such as SUSE Linux Enterprise Server 9 makes it unlikely that Sun can achieve its goals.

Sun faces several challenges with its Solaris 10/x86 and OpenSolaris strategy:

- *Limited platform architecture support*
- *Continued defection of its installed base to Linux*
- *Continued drop in market share*
- *Limited open source community around OpenSolaris*
- *Lackluster ISV support for Solaris 10/x86*
- *Limited IHV support*
- *Altering a culture that views Solaris/SPARC as its primary revenue generator for the future*
- *Continued underestimation of the threat of Linux and commodity hardware platforms*

Many users have indicated that Solaris 10/x86 will likely neither stop nor slow their migrations from Solaris to Linux. It is too late for many of them to stop. Large numbers of users view Sun with skepticism. Historically, the company has been inconsistent in its support for x86 platforms.

Linux operating system platforms such as SUSE Linux Enterprise Server 9 continue to outdistance rivals in terms of performance, security, stability and rate of growth. SUSE Linux Enterprise Server (version 9 in particular) is the most competitive of the Linux operating systems in terms of challenging RISC/UNIX platforms such as Solaris 10 and Windows in performance benchmarks. With the addition of Novell AppArmor, Powered by Immunix, SUSE Linux Enterprise Server 9 competes with Solaris in protecting users from security vulnerabilities.

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